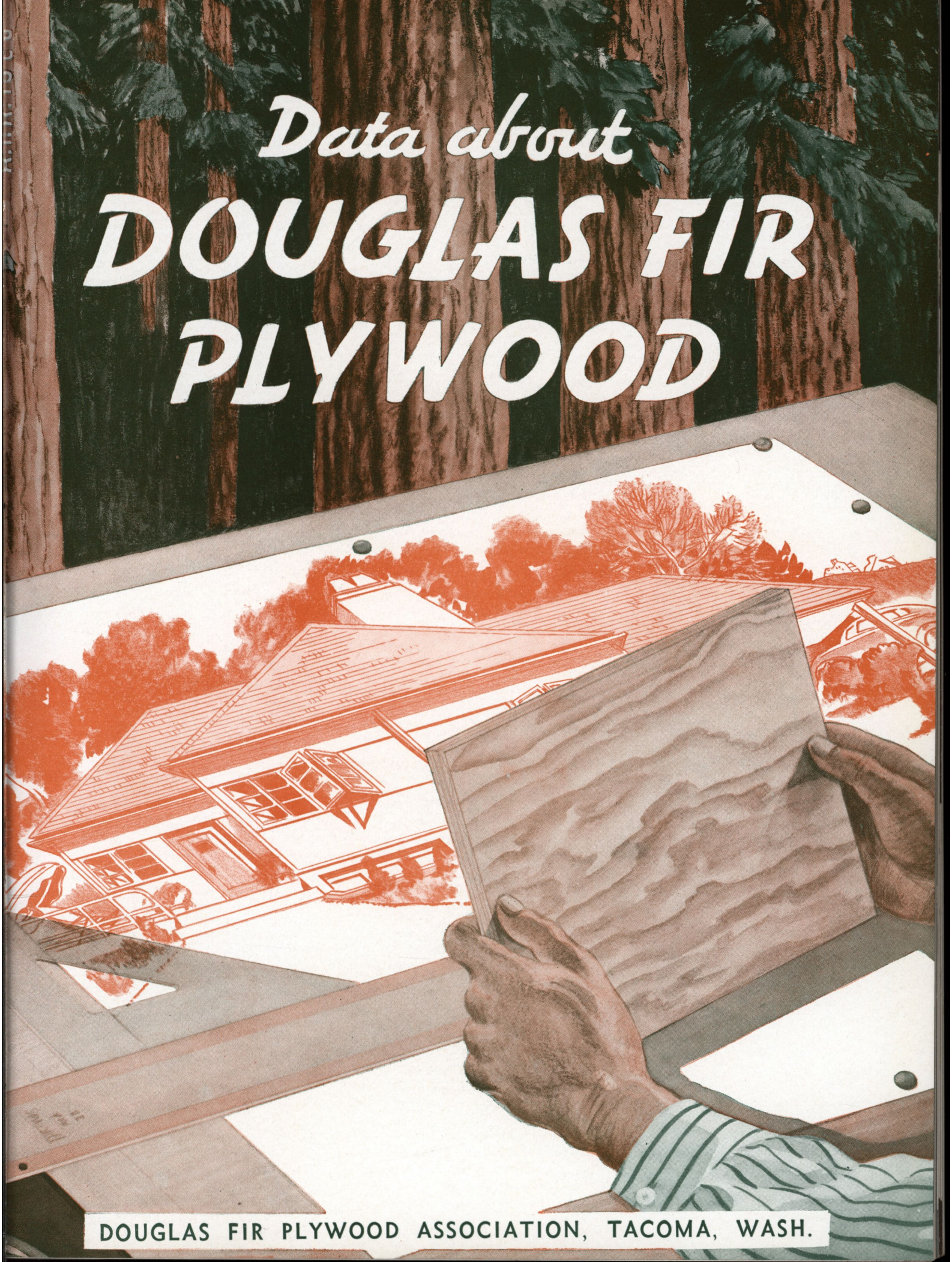
Data about DOUGLAS FIR PLYWOOD



DOUGLAS FIR PLYWOOD ASSOCIATION, TACOMA, WASH.

DOUGLAS FIR PLYWOOD ASSOCIATION

Tacoma Bldg., Tacoma, Wash.

THE ASSOCIATION

A non-profit organization of United States manufacturers of Douglas fir plywood, founded to sponsor a continuing program of technical research, to promote the use of this material in construction and industry, and to help users employ it to the best advantage.

Inquiries as to the characteristics or uses of Douglas fir plywood will receive prompt attention. Address DOUGLAS FIR PLYWOOD ASSOCIATION, Tacoma Bldg., Tacoma, Wash., or any of the following industry mills:

ABERDEEN PLYWOOD COMPANY
Aberdeen, Washington

BUFFELEN LUMBER & MFG. CO.
Tacoma, Washington

CAPITOL PLYWOOD CO.
Olympia, Washington

ELLIOTT BAY MILL COMPANY
Seattle, Washington

HARBOR PLYWOOD CORPORATION
Hoquiam, Washington

M & M PLYWOOD CORPORATION
Portland, Oregon

NORTHWEST DOOR CO.
Tacoma, Washington

OLYMPIA VENEER COMPANY, INC.
Olympia, Washington

OREGON-WASHINGTON PLYWOOD CO.
Tacoma, Washington

THE PLYLOCK CORPORATION
Portland, Oregon

ROBINSON MANUFACTURING CO.
Everett, Washington

SMITH WOOD-PRODUCTS, INC.
Portland, Oregon

UNITED STATES PLYWOOD CORPORATION
Seattle, Washington

VANCOUVER PLYWOOD & VENEER CO.
Vancouver, Washington

WASHINGTON VENEER COMPANY
Olympia, Washington

WEST COAST PLYWOOD CO.
Aberdeen, Washington

WHEELER OSGOOD SALES CORPORATION
Tacoma, Washington

THE PRODUCT

Douglas fir plywood consists of an odd number of thin sheets, or veneers, of selected old growth Douglas fir—3, 5, or 7 in. standard thicknesses—these being laminated with alternating grain direction. The major processes of manufacture are illustrated on this page.

The water-resistant glue used, after setting under hydraulic pressure, forms a bond of high shear strength, far stronger, in fact, than the wood fibres themselves.

In the manufacture of Douglas fir plywood only the choicest Douglas fir logs are used. Douglas fir grows on the Pacific slope, where climatic conditions produce a wood combining soft texture and light weight with extraordinary strength. Because of these characteristics, Douglas fir is widely specified for heavy structural timbers.

PHYSICAL CHARACTERISTICS

Test Data on pages 10 and 11

Because the veneers are rotary cut, not sawn, Douglas fir plywood is available in standard sizes as large as 4 x 8 feet—and in even larger sizes on special order. Largely because of these sizes, Douglas fir plywood makes possible savings of 40% to 75% over ordinary lumber in handling and labor cost.

Because the grain of each ply composing the material is at right angles to the grain of adjacent plies, the strength of a Douglas fir plywood panel is approximately equal in both directions. By contrast, the tensile strength of ordinary lumber may be twenty times as high parallel to the grain as across it and the modulus of elasticity from fifteen to twenty times as high. Therefore, a panel of Douglas fir plywood will do the work of solid lumber very much thicker and heavier.

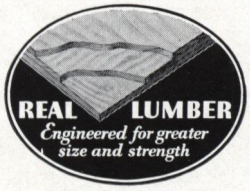
On account of its cross lamination, Douglas fir plywood has no plane of cleavage. Hence, although it is possible to smash the edge of a panel with a heavy axe, it cannot be split.

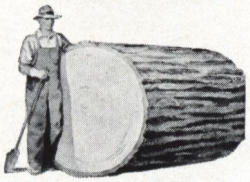
As each veneer, or ply, is scientifically dried before the gluing process, and as any tendency of an individual ply to shrink or expand is prevented by the opposing grain of adjacent plies, Douglas fir plywood is extraordinarily warp-resistant. Once in place, it is warp-proof. Moreover, nails and screws can be driven to the very edge.

A grade and thickness of Douglas fir plywood suitable for virtually every purpose is now available. (See page 11.) It can be obtained through building material dealers in every section of the country, but if unavailable in any particular community, a letter to any of the mills listed on this page will bring the name of their nearest dealer.

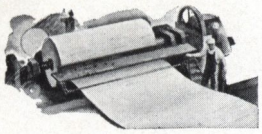
All Douglas fir plywood from Association mills is now made to conform with the new moisture-resistance requirements set forth in the revised standards recently (November 10, 1938) established by the National Bureau of Standards, as U. S. Commercial Standards 45-38.

How Douglas Fir Plywood Is Made

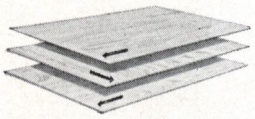




1 Selected Douglas fir logs are cut to length and barked.



2 Then turned on a giant lathe and peeled off into endless lengths of thin wood sheets.



3 These sheets of wood are cut to size, laid cross-grain, and glued together flat with water-resistant glue under hydraulic pressure. (Arrows show direction of grain.)

4 The result is giant panels having all the good qualities of natural wood plus size and convenience,—but with advantages of strength, stiffness, and freedom-from-splitting.

Simultaneously, registered grade-marks and trademarks for all standard panels were adopted by the Douglas Fir Plywood Association mills.

PLYSCORD in a circular stamp will appear on every panel of genuine sheathing grade. Plyscord will also be stamped in parallel lines 16″ apart across the fame for convenience in nailing.

PLYWALL in a square stamp will appear on the back of every panel of genuine Wallboard grade.

PLYPANEL-DFPA will appear on the edge of every genuine panel grade of plywood (Good 2 Sides; Good 1 Side; and Sound 2 Sides).

PLYFORM in a diamond-shaped stamp will appear on one face of every panel of genuine Concrete Form Panel grade.

EXT-DFPA will appear on the edge of every panel of genuine exterior type of plywood, suitable for permanent exterior service, and now made by the hot pressed, resin-bonded process.

These grade marks and trademarks are designed to protect the purchaser of plywood and to assure him that he will always receive the exact grade he specifies.

Plywood, ¼″ thick, over studs spaced 16″ on centers, has been accepted by the FHA in their general ruling No. 67, June, 1937. This item in the wallboard grade is most widely used for walls and ceilings, although for more substantial construction ⅜″ or even thicker is sometimes preferred.

Following promulgation of the grade marking program, the FHA accepted Exterior plywood with certain structural limitations.

SUGGESTED SPECIFIC APPLICATIONS FOR INTERIORS

DOORS—For door panels and dustproof flush doors, Douglas fir plywood has found world-wide acceptance. It combines light-weight strength with extraordinary warp resistance.

BUILT-INS—For cabinets, shelving and built-ins, Douglas fir plywood is preferred material because of the large panel sizes, the freedom from splitting and warping, the ease of nailing and screwing near edges and the variety of thicknesses available for particular and varied uses.

WAINSCOTING—Wainscoting with plywood is especially popular because it is not easily damaged nor marred, does not show water spots and can be adapted to any decorative scheme.

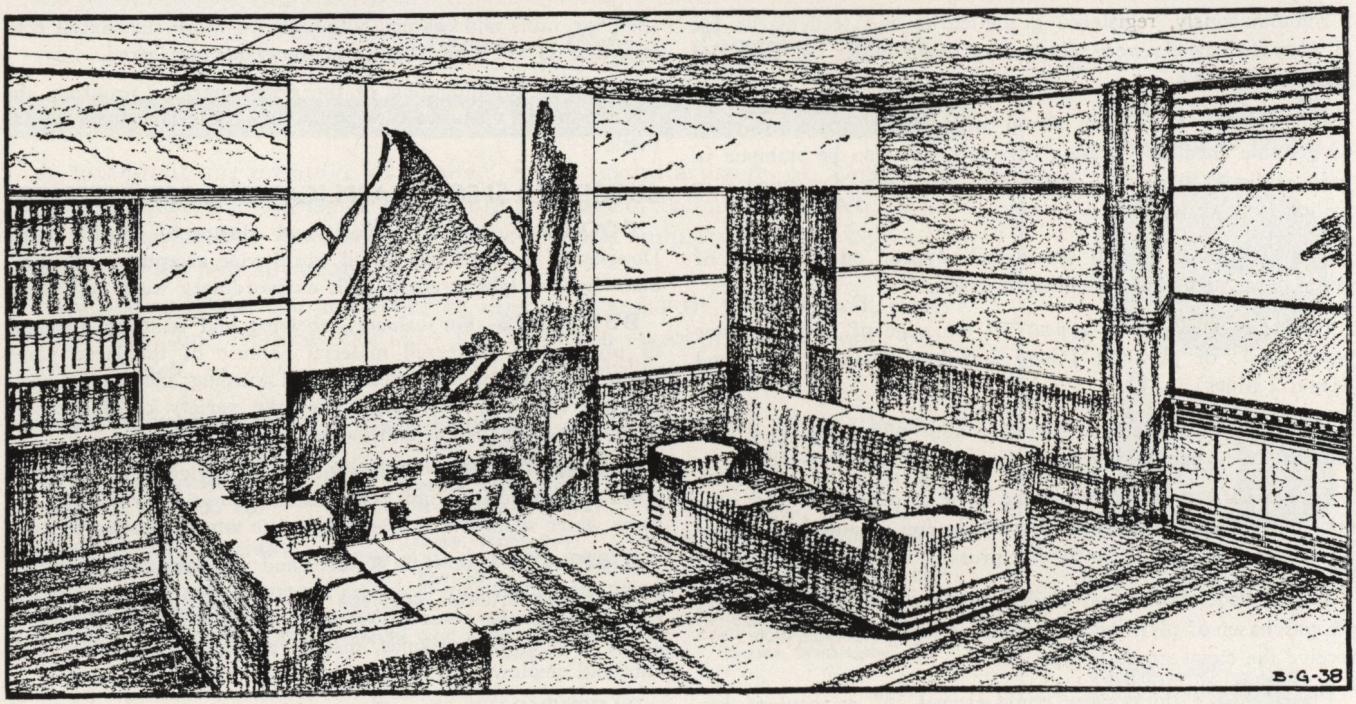
DISPLAYS—For store fixtures and displays, plywood offers architects and display designers a material that is easy to work, rigid and can be re-used for store fixtures and window displays, such as backgrounds, display props, special niches, cut-outs and shadow boxes.

PARTITIONS—For office partitions, whether permanent or removable, Douglas fir plywood provides a rigid, attractive and workable material. An economical partition of plywood—if not less than ½″ thick—may be constructed with simply a cap and shoe.

Architect Tennys Francis Bellamy selected Douglas fir plywood natural finish as the interior for the recreation room in the Blue Ridge Model Home.

Waiting room in a modern office building as designed by Architect W. F. Ruck showing effective treatment of Douglas fir plywood in a natural finish.

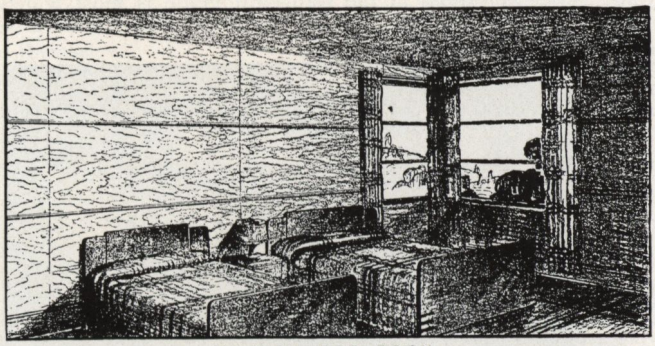
» CHARMING MODERN INTERIORS WITH PLYWOOD «



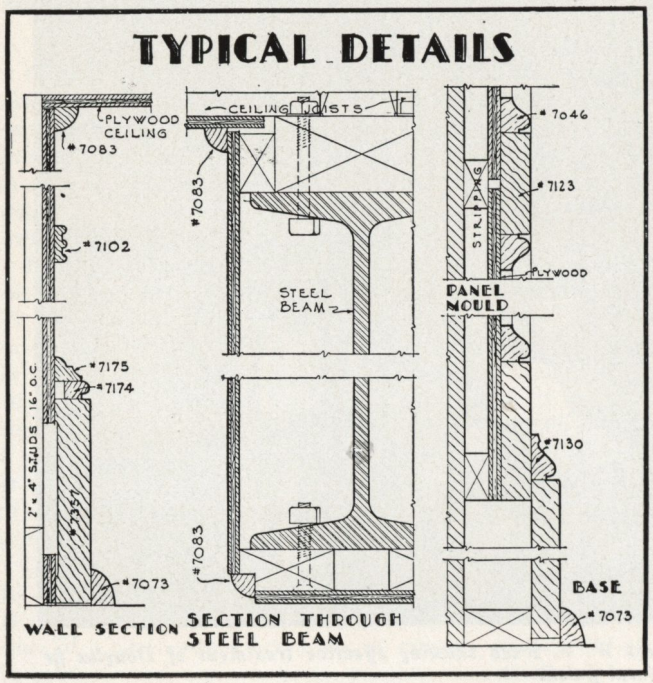
MODERN LIVING ROOM

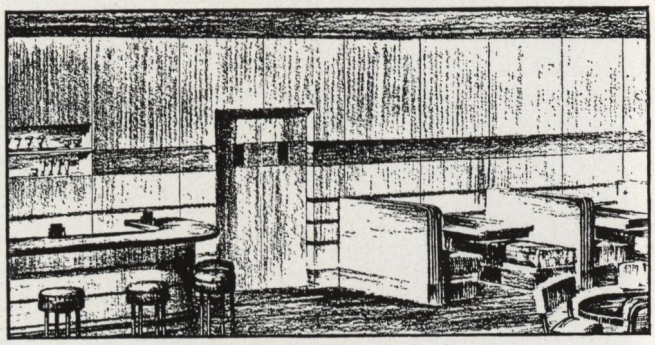
The renderings and details on this page were prepared by Carl F. Gould, F.A.I.A., as suggestions to architects and builders of possible methods of applying Douglas fir plywood as decorative panels in modern house and store design.

Where paneling of practically clear veneer made of a single large sheet is desired, the Good 1 Side grade is recommended. For most purposes, however, where a few neat face patches are not objectionable or for paint finishes, the Wallboard grade is entirely suitable and is generally preferred. For standard 16″ stud spacing, ¼″ panels are adequate.



MODERN BED ROOM

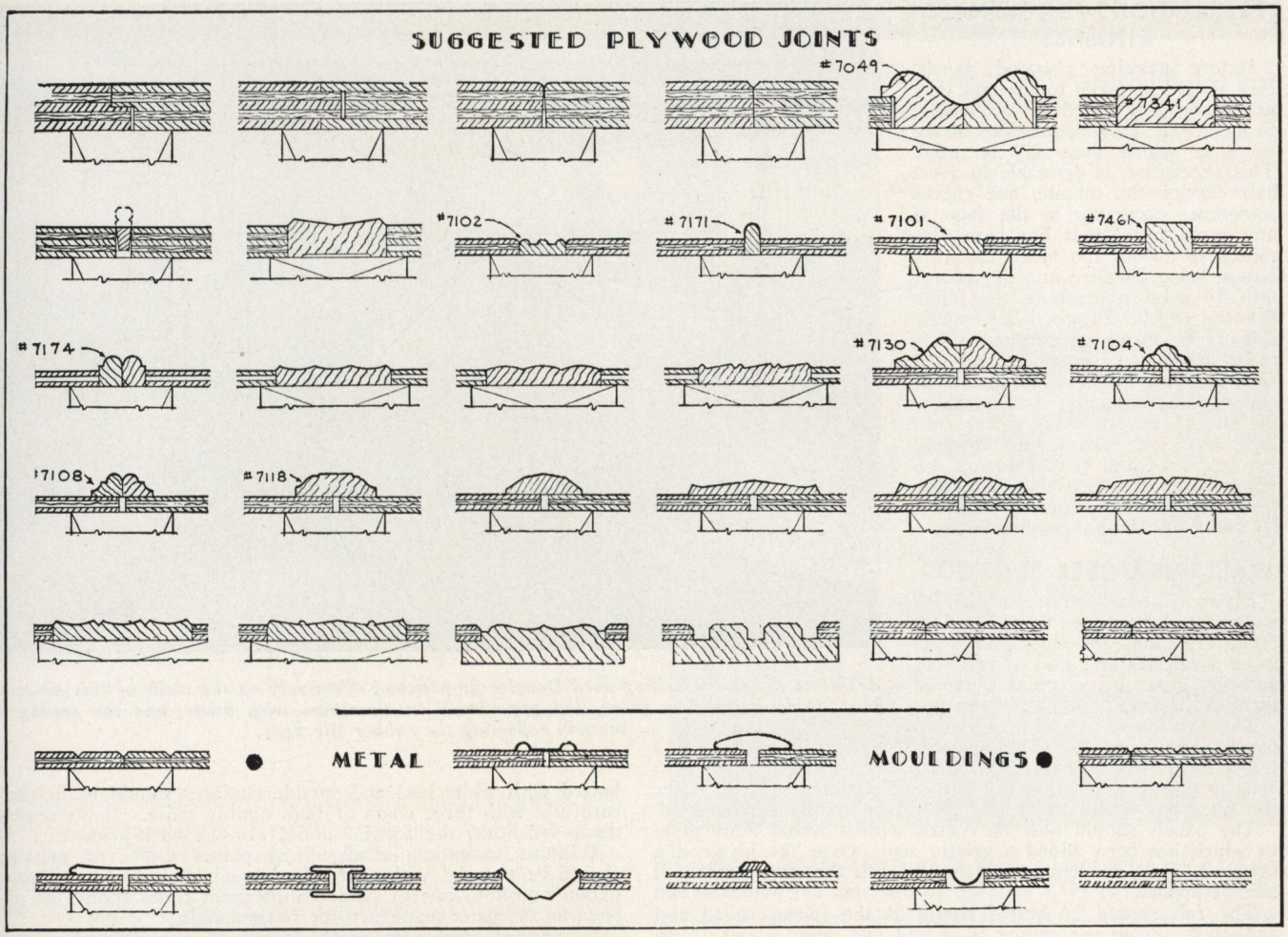




RESTAURANT AND BAR

The 4d casing or finishing nail is recommended for paneling up to ½″ thick with the nails spaced from 6 to 10″. One horizontal header or fire stop should be cut in between studs midway between top and bottom plates as a nailing piece.

Details by competent architects will help to bring Douglas fir plywood the recognition it so richly deserves as a beautiful and charming material in its own natural color.



ATTRACTIVE FINISHES

Plywood panels may be finished in a number of ways, including staining, painting, wall papering and mechanical surfacing. For the discriminating lover of wood, the beauties of the natural grain are best revealed by clear lacquer, wax and light stains. The character and distinctiveness of the grain of Douglas fir plywood permits a variety of pleasing effects and averts monotony, although panels may be selected for matched appearance where desired.

STAINING

Where Douglas fir plywood is to be stained, panels should be sealed with a clear, resin sealer. These sealers applied at the mills directly after sanding (and dusting) prevent subsequent stain coats from penetrating into the soft springwood of Douglas fir. As a consequence an even distribution with a softened grain tone is effected and both moisture penetration and grain-raising are practically eliminated. Steps to produce stained finish may be tabulated as follows:

Flat Stain	Gloss Stain	Lacquer
Stain	Stain	Stain
Coat of shellac	Shellac	Lacquer sealer
Sand	Sand	Clear lacquer (flat or gloss)
Flat varnish	Gloss varnish	

PAINTING

A painted surface may be desired where the grain of the wood will be entirely concealed. Several finishes are then available and may be obtained by using the following specifications:

Egg Shell	Stippled	Paint, Plaster, or Rough Texture	Gloss Enamel
Lead & Oil Primer or resin sealer	Primer or sealer	Primer or sealer	Primer or sealer
Undercoater	Undercoater	1 coat of stippled paste; skilled painter can produce finish as specified by architect	Undercoater (2 coats preferable)
Egg shell enamel	Stippled paste		Gloss enamel recommended; glaze coat, and special care in jointing and in using dry panels
Optional (1 coat of glaze color to soften finish-wipe before drying)	Optional (glaze coat to soften finish)		

The variety texture known as stippling is one of the simplest, commonest, and most satisfactory interior finishes. It is accomplished by striking the wet paint with a wall stippling brush. It eliminates brush marks and imperfections in the surface.

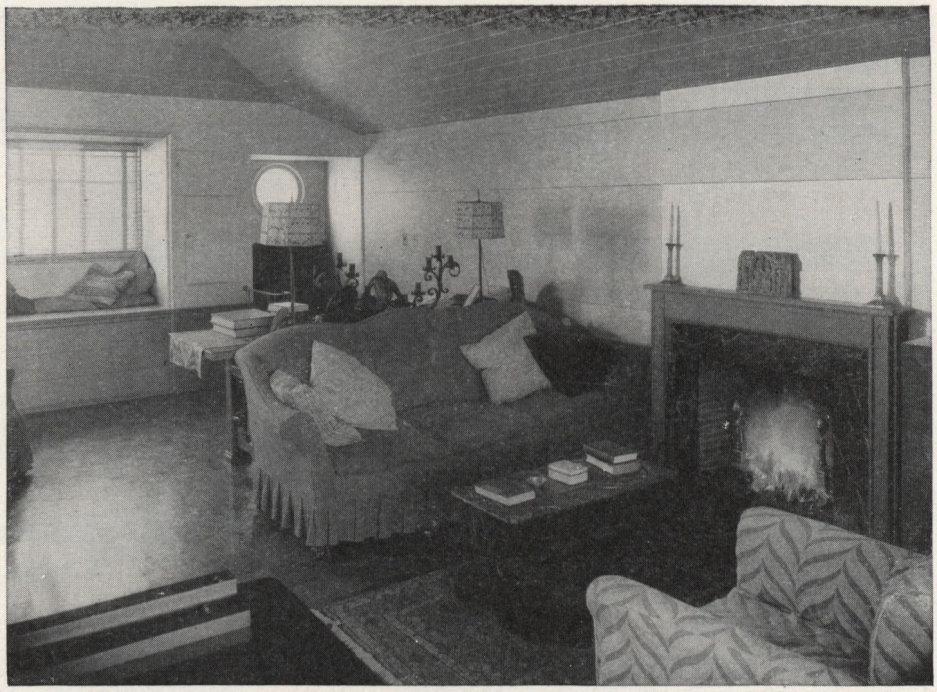
Furthermore, finishes with a certain amount of relief, providing texture and depth, can be produced with white lead plastic paint for the finishing coat.

SINGLE PRIMING COATS AS FINISH

Attractive and economical finishes on Douglas fir plywood may be obtained by using a resin sealer and then priming with a single priming coat, tinted with any desirable color, such as tan or brown, that will blend with the furnishings and permit the grain of the Douglas Fir to show through the priming coat in subdued, warm patterns.

PRECAUTIONS FOR PAINTED FINISHES

Before painting plywood panels, care should be taken to see that they are thoroughly dried or acclimated to the actual service conditions of the room in which they will be used. This precaution is desirable to avert hair checks—the minute, fine checks sometimes occurring in the face of any wood panel that has been permitted to absorb too much moisture before being installed in a dry room; also, to avert a crack in the joints between panels. Plywood is virtually free from shrinkage because of its cross laminated structure and the fact that wood does not shrink or expand longitudinally, that is, along the grain; nevertheless, unless care is taken, an almost infinitesimal movement of the panels or of the framework on which they are fastened, may cause a crack which will be noticeable in an enamel finish.



Architect Ralph Flewelling used Douglas fir plywood effectively on the walls of this modern den. Dado finished in green, the upper wall in aluminum with white, and the ceiling a maroon reflecting the rubber tile floor.

WALLPAPER OVER PLYWOOD

Plywood's popularity as a base for wallpaper is attributed to its freedom from cracking, its smoothness, its large panel size and ease of erection, and the general economies obtained through its use.

The Wallboard grade of plywood panels should be closely butted with joints filled with a good joint filler, such as plastic wood, Swedish putty, or similar material. After the filler has dried, the joints should be lightly sandpapered.

The panels should now be coated with a wheat flour paste to which has been added a gelatin size. Over the plywood a layer of ¾ lb. deadening felt treated with the same paste and size, is applied.

The felt should be butted neatly at the joints, rolled and smoothed. From the ceiling it should run down about 1″ on the sidewall so that the strips applied to the sidewall will lap about 1″ over the ceiling strips. Many decorators also go over the felt with a smoothing brush to assure uniform adhesion to the plywood.

When the felt has been entirely installed, the wallpaper is hung in accordance with standard practice, using ordinary wheat flour paste.

FINISHING PLYWOOD FOR INTERIORS

Only the Exterior grade of Douglas fir plywood should be used for permanent exterior exposures. Edges are preferably knifed with white lead and outside surfaces should be finished carefully with three coats of high quality paint. In extremely damp localities, the panels should also be back-primed.

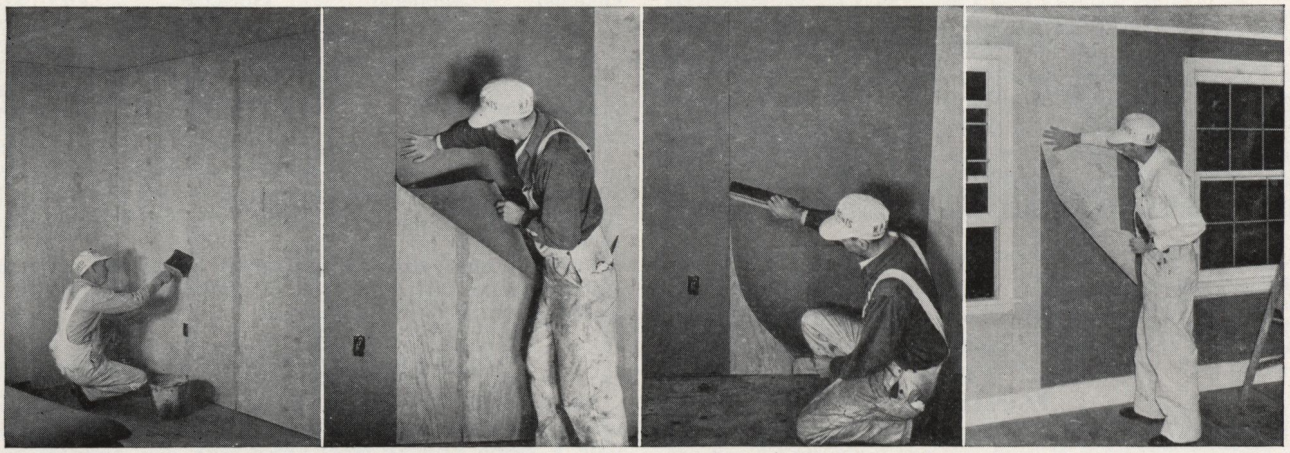
Without exception, ready-mixed paints used for priming should be reduced with pure raw linseed oil—usually with one gallon of oil to one of paint. Subsequent coats should be applied as the paint manufacturer recommends.

In mixing aluminum paint, which is especially moisture-resistant, only high grade vehicles—such as kettle-bodied oil or long oil spar varnish—should be used. Ordinary boiled oil or raw linseed oil should not be used. Many paint manufacturers now offer a vehicle specifically prepared for aluminum powder.

On large, unbroken surfaces, priming and subsequent coats, such as calcimine, should be applied by sweeping the brush in a semi-circular fashion. If the surface is small or broken by paneling, it is best to follow the grain.

Driers should be used very sparingly. Shellac should never be used on Douglas fir plywood which is exposed to the weather.

HANGING WALLPAPER OVER PLYWOOD

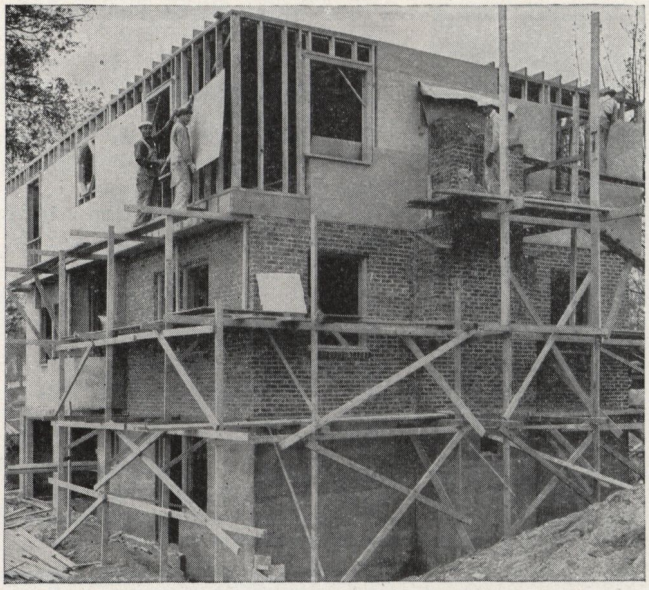


Sizing the plywood with wallpaper paste, before hanging felt.

Straight edge ¾ lb. felt is tightly butt-jointed.

Felt is carefully smoothed to assure uniform adhesion.

Wallpaper is then hung in accordance with standard practice.



PLYSCORD *sheathing, 5/16" in thickness, being applied to the walls of a modern home. Note the compact, tight appearance of the structure, the ease with which the panels can be handled by one man.*

Douglas fir plywood for sheathing and subflooring has been accepted by building authorities throughout the country, including the FHA, the Pacific Coast Building Officials Conference (the Uniform Building Code has been adopted by more than 200 cities and towns from California to Maine), and has been established as a material of structural superiority through a comprehensive series of tests at the U. S. Forest Products Laboratory (see chart), the University of Washington, Stanford University, and many municipal building departments.

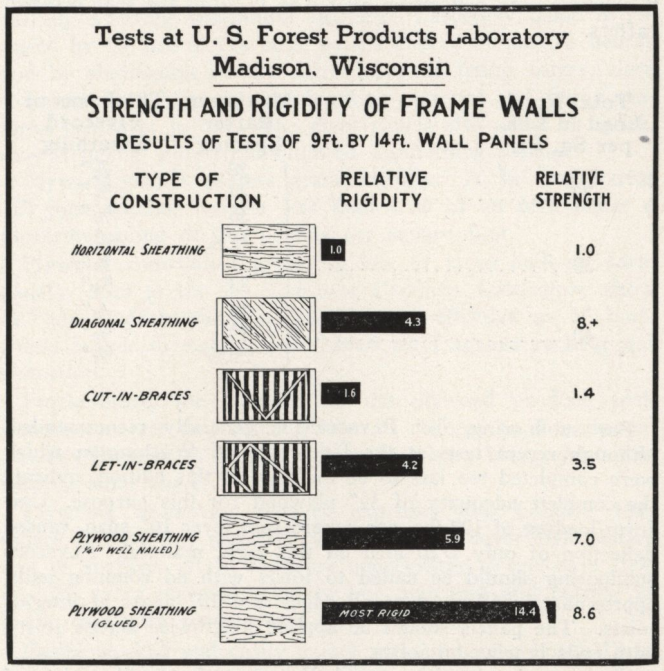
The 5/16" thickness of Douglas fir plywood sheathing is listed as one of several acceptable materials for exterior wall and roof sheathing by the FHA in Revised General Ruling No. 61 (dated June 29, 1937, and still in effect). Similarly the 5/8" thickness of Douglas fir plywood is listed as acceptable for subflooring with joist spacing of 16 inches. Exterior plywood is also accepted by the FHA with certain structural limitations.

This recognition by government authorities, following laboratory tests and approval, supplements the practical experience of architects and builders who have found plywood an outstanding material for sheathing and subfloors. It possesses proven structural superiority, insulating and windproofing properties and definite economies in application.

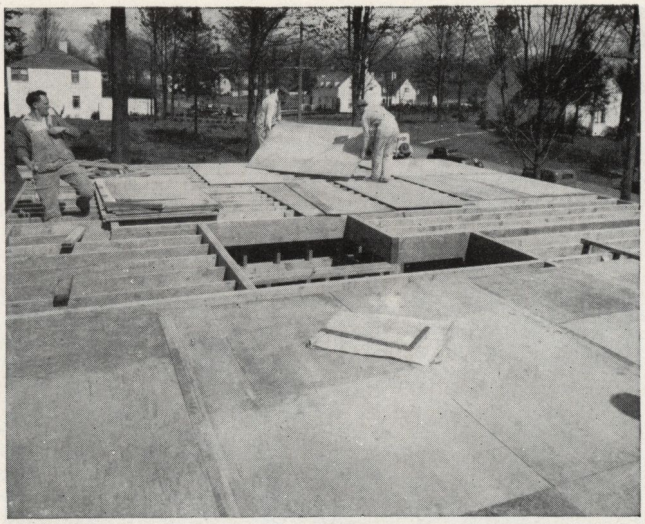
The stiffening properties of Douglas fir plywood as a wall, floor or ceiling covering render it particularly suitable as a structural material in earthquake and mining regions where public buildings must be designed to resist horizonal impact stresses from earth movements.

Vapor barriers may be necessary in walls in those areas where condensation is a problem due to high humidities and low outside temperatures. Where required they should, according to Professor F. B. Rowley of the University of Minnesota, be placed on the inner or warm side, and not on the cold or sheathing side of the wall where the exit of moisture from wall cavities may be prevented. On the inner walls, two coats of asphalt paint on the back of Douglas fir plywood interior wall paneling or a layer of asphalt coated and impregnated sheathing paper (weighing 50 pounds per roll of 500 square feet) applied to the studs and ceiling joists before applying the plywood makes a highly effective vapor barrier at very low expense, according to tests made at the U. S. Forest Products Laboratory.

No material waste, savings up to 50% on labor costs and a reduction in overall job time may be expected when PLYSCORD *sheathing is used on walls and roofs under shingles, shakes, brick or other conventional siding or roofing.*



Note that walls sheathed with Douglas fir plywood are 6 times as rigid as those sheathed horizontally with conventional shiplap and 40% more rigid than those sheathed diagonally.



PLYSCORD *subfloor, 5/8" thickness, is quickly installed. This makes a warm, squeakless subfloor suitable for conventional finish floors, linoleum or other resilient flooring. Room partitions and built-ins may be marked on this clean subfloor with ease.*

PLYSCORD—A NEW GRADE

Douglas fir plywood is now available in a new and improved grade known as PLYSCORD. Grade-marked, trade-marked and scored for ease of nailing on 16" centers, this new construction material has an improved face, is available in panels 32" and 48" wide, 96" long and in three popular thicknesses, 5/16", 3/8" and 5/8".

Exterior walls are sheathed with the 5/16" thickness to which shingles may be directly applied as proved by extensive tests at the University of Washington under Professor Bror L. Grondal who states, "Douglas fir plywood, as a base for western red cedar shingles, provides the necessary nail-holding qualities, even when 5/16" plywood, the thinnest tested, is used." This sheathing should be applied with 6d nails, spaced 6" apart at edge bearings and 12" apart elsewhere.

For roof sheathing, the following table shows PLYSCORD thicknesses with deflections limited to 1/270 of the span between rafters.

Total Roof Load in Lbs. per Sq. Ft.	Maximum Rafter Spacing	Thickness of Plyscord Sheathing
20	20	5/16"
	24	3/8"
	36	5/8"
30	17½	5/16"
	21	3/8"
	33	5/8"
40	16	5/16"
	19	3/8"
	29½	5/8"

For subflooring, 5/8" PLYSCORD is generally recommended, although recent tests at the University of Washington which were completed too late to be included in this edition, indicate the complete adequacy of ½" plywood for this purpose. Uniform loading of 100 lbs. per square foot, over 16" span, caused deflection of only 1/20 inch on this rigid material. PLYSCORD subflooring should be nailed to joists with 8d common nails, approximately 6" apart at all edges and 10" apart at interior joists. The panels should be applied lengthwise across joists, with ends bearing on joists.

Contractors who have used PLYSCORD for wall and roof sheathing and subflooring report savings up to 50% on labor costs due to the ease and rapidity with which the large panels can be installed; they comment on the large reduction in material waste; they point out the overall saving in job time; and, they declare that the saleability of their houses is improved through the tight, compact, dustproof and windproof appearance of this sheathing and subflooring material with its minimum linear footage of joints.

DETAILS FOR APPLICATION

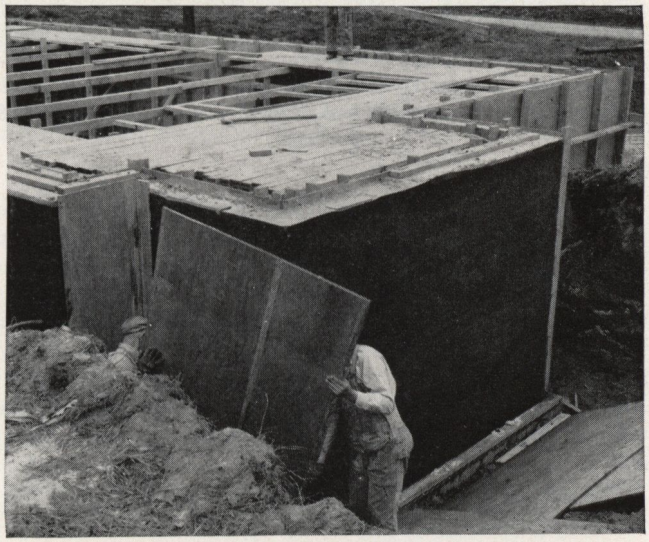
PLYSCORD sheathing, 5/16" in thickness, and ¼" interior wall paneling produce a thinner wall section but permit the use of standard stock window frames in several different ways:

(1) Moulding strips around the outside window trim may be used to close the gap between the sheathing and the outside casing.

(2) The stock frame may be slid inwards against the sheathing and moulding strips used around the inside trim to close the space between the wall paneling and the trim.

(3) One-half inch furring strips may be used over the outside wall (this produces a double air-space and thereby increases the insulation value of the wall).

Stripping 5/8" PLYSCORD sheathing from the concrete foundation. This material will then be used for the subfloor. As concrete form material, plywood produces a smooth finish on the concrete, thereby reducing rubbing and finishing costs.



»» DRI-BILT DATA ««

Dri-Bilt construction, which has created so much interest during the past year, is simply the use of Douglas fir plywood over standard framing. Wall and roof sheathing, subflooring and interior wall and ceiling covering are all of plywood for maximum rigidity, economy and simplification of interior finish.

Standard framing practise is followed with 16" stud and joint spacing, but by means of a few minor modifications, involving no extra expense, the application of stock plywood panels 4x8' in size is made more economical with practically no cutting except for openings.

For example, the first stud can be set 16" from the outside edge of the corner post so that by maintaining 16" spacing, the edges of standard panels come directly over the studs; similarly for floor joists except that the outside joist and the built-up sill is set out 5/16" from the face of the studs, thus averting the necessity of running exterior sheathing down over the sill. This also permits the use of standard 4x8' sheathing panels placed either horizontally or vertically, without cutting except for openings. Where possible the face of wall partitions is an even multiple of 4' from the opposite wall, again to eliminate the cutting of the standard 4' panels.

The heat conduction coefficient of the Dri-Bilt wall, without any added insulation, varies from .239 to .296 BTU.

» CONCRETE FORM PANELS FOR ARCHITECTURAL CONCRETE «

The smooth finless surfaces demanded for architectural concrete buildings, as well as for bridges, viaducts, warehouses and residential foundations are obtained with PLYFORM, the Concrete Form Panel grade of Douglas fir plywood.

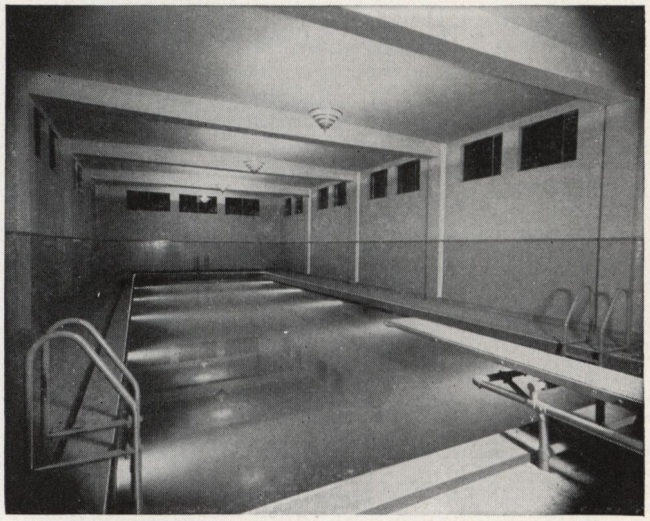
These panels, made with special highly water-resistant glues and grade-marked by Association mills for ready consumer identification, have demonstrated their superiority on thousands of jobs throughout the country.

Outstanding assets of this Concrete Form Panel grade are:

1. They may be re-used from 7 to 15 times and more.
2. They effect important savings in carpentry labor.
3. They save up to $100 a thousand feet in rubbing and polishing labor.
4. They permit of faster stripping of forms.
5. They form smooth, finless surfaces.
6. Their giant size reduces the linear footage of joints.

PLYFORM is stocked in sizes up to 4x8′ and in thicknesses of ½″ to ¾″. Many contractors prefer the ⅝″ or ¾″ thickness. Where curved surfaces are desired and only one or two uses are needed, or where the building design or size does not permit several re-uses of form material, many contractors and architects use ¼″ plywood in the Wallboard grade for lining forms. This thickness can be easily bent to a 12″ radius providing the curve is across the panel.

Concrete Form Panels of Douglas fir plywood used on Columbia Broadcasting Company's KNX Studios in Hollywood by William Lescaze, Architect, and Earl Heitschmidt, Associate.



Interior of Marquette Cement Company's employees' Natatorium at Cape Girardeau, Mo., which was formed with Douglas fir plywood. Note natural finish and painted wainscot.

On concrete form work where the maximum re-use is desired, the Exterior grade of PLYFORM with the strictly waterproof bonding agent, may be specified.

SPECIFY PLYFORM

These panels are officially grade-marked by the Douglas Fir Plywood Association and should be specified for concrete work since the specially improved binding agent used in the manufacture of this grade insures quality performance on the job, thereby assuring substantial savings. Carpentry labor is reduced by the use of the large panels instead of narrow boards and by elimination of the extra labor of lining forms, since Concrete Form Panels are sheathing material and lining material combined in one. The giant panels also admit of quick, easy stripping with a minimum of dismantling damage.

Plywood panels possess grade rigidity. A ⅝″ panel over 12″ joist spacing deflects less than 1/50 of an inch under a uniform loading of 225 pounds per square foot.

Plywood contributes great rigidity to large built-up form panels; tests at the U. S. Forest Products Laboratory show ¼″ plywood sheathing is 5.9 times as effective as 1″ horizontal boards in making wall panels rigid against racking and distortion.

Furthermore, the surfaces of the plywood produce such smooth concrete that rubbing labor is reduced to a minimum. Savings from 5c to 12c per square foot have been reported in rubbing labor alone.

Plywood, moreover, reduces expenses also because 1000 square feet of this material can be used to cover 1000 square feet of surface. It is therefore unnecessary to purchase 20% to 30% extra material to allow for matching and cutting as is the case with conventional form material.

Easily worked and easily nailed without boring holes, 12 to 15 re-uses of plywood, Concrete Form Grade, are reported on many jobs, including the roadway of the San Francisco-Oakland Bay bridge. Where the Exterior grade of plywood is used as many as 55 re-uses is not uncommon.

Finally, the Concrete Form Grade of Douglas fir plywood may be salvaged for various utility uses, such as, sheathing, subflooring and fencing.

ARCHITECTURAL EFFECTS

Unlimited areas of unbroken plane surfaces may be cast with Douglas fir plywood Concrete Form Panels. Moldings on the face of forms permit the architect to create "struck joint" effects. Ornamentation through reverse molds readily applied to plywood limited only by the skill of the craftsman.

Write the Association for special new technical Handbook on the Use of Douglas Fir Plywood for Concrete Forms.

» DEFLECTION CHARTS «

These charts show deflection of Douglas fir plywood when acting as a simple beam, i.e., resting on only two supports, *without any nailing.*

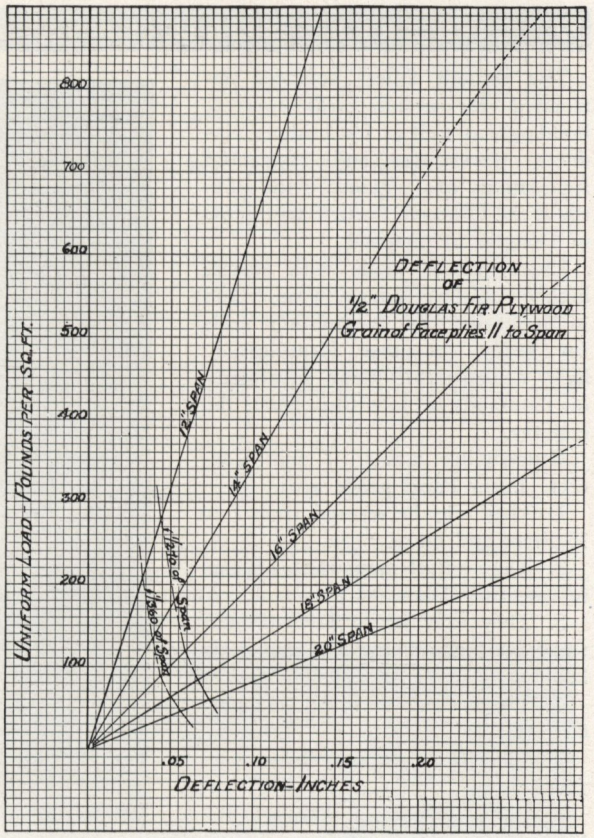
The charts are based on a comprehensive series of tests conducted recently at the Forest Products Laboratory of the University of Washington. The results are in accord with the theoretical deflections computed as tentatively recommended by the United States Forest Products Laboratory at Madison, Wisconsin.

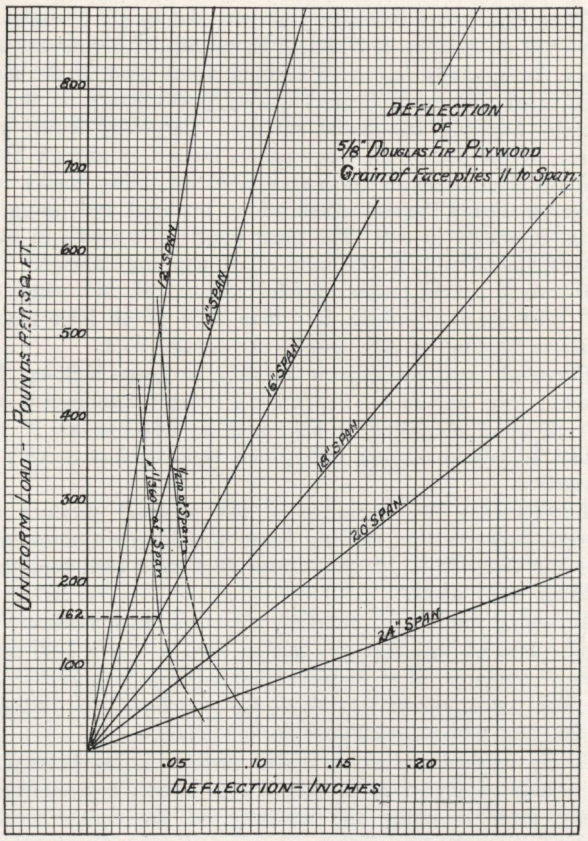
For convenience, lines have been added to show deflection of 1/360th and 1/270th of the various spans. For example, using ⅝-in. plywood over a 16-in. span, with deflection limited to 1/270th of span, as in most concrete work, a loading up to 221 lbs. per square foot may be used. If the supports are placed only 12 in. apart, the loading may be increased to 510 lbs. per square foot.

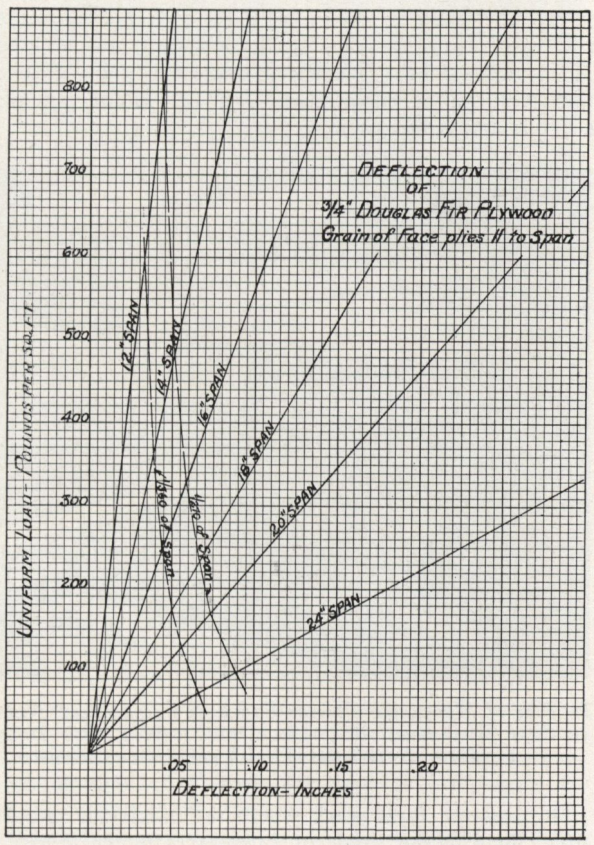
If load is continuous over two or more spans, the deflection will be approximately ½ that shown, and therefore, twice the load shown may be used.

The charts show the deflections of Douglas fir plywood when the grain of the face plies is parallel to the span, i.e., when panels are placed lengthwise across the supports. When panels are placed parallel to the supports, the loads causing any given deflection will be smaller than shown on the charts, as follows:

For ½-in. thickness, use 40% of load on chart;
For ⅝-in. thickness, use 50% of load on chart;
For ¾-in. thickness, use 75% of load on chart;
for any given span and allowable deflection.







»PLYWOOD TEST DATA«

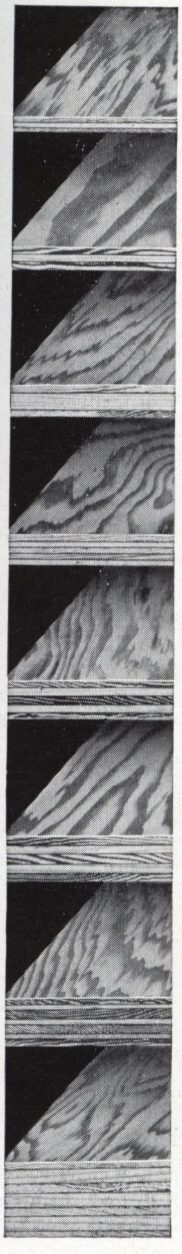
In order to present a general comparative picture as to the strength properties of Douglas fir plywood, and other materials sometimes used in its place, the results of a series of tests conducted at the Northwest Testing Laboratory, the Northwest representative of the nationally-known Pittsburgh Testing Laboratory, are summarized at the right:

In the tension tests, all specimens were 3″x18″; in the compression tests, 6″x6″ pieces were used. Tests on each material were conducted under exactly the same conditions.

Thickness of material	Tension		Compression	
	Ultimate load	Ultimate stress	Ultimate load	Ultimate stress
LOAD ACTING WITH THE GRAIN OF FACE PLIES				
¼″, 3-ply	5250	6484	4198	2855
⅜″, 3-ply	5644	4750	6630	2860
½″, 5-ply	8024	5135	10492	3497
⅝″, 5-ply	8132	4350	10644	2893
¾″, 5-ply	8912	4074	18538	4186
LOAD ACTING ACROSS GRAIN OF FACE PLIES				
¼″	2552	3291	908	609
⅜″	4684	4141	5206	2180
½″	7664	5108	6462	2162
⅝″	8326	4491	9096	2472
¾″	8796	3932	15262	3436
TESTS ON OTHER MATERIALS				
A-3/16″	1248	2189	390	346
B-3/16″	1276	2180	846	751
C-¼″	264	352	826	550
D-7/16″	152	126	448	170
E-½″	370	248	690	230

Key: Material A, old-style fibre wallboard; B, hard, compressed board; C, plaster-board; D and E, insulating boards.

Representative Plies and Thicknesses of DOUGLAS FIR PLYWOOD



¼ in.—3 ply

Used largely for drawer bottoms, case and picture backs, and toys. Most Douglas Fir Plywood wallboard is made in this thickness.

⅜ in.—3 ply

Manufacturers of refrigerators, trunks, kitchen cabinets, store fixtures, auto body parts, and instrument cases use this construction.

½ in.—3 ply

This is an economical shelf material for cabinets of all kinds. Also used in auto body parts, incubators, etc.

½ in.—5 ply

This construction is superior to that just above, both in tensile and in transverse strength. When ½ in. is required in large sheets this construction is recommended.

⅝ in.—5 ply

In floor boards, lock boards, seat frames and other automobile body parts and for concrete forms, etc., this thickness finds especial favor.

¾ in.—5 ply

Used by auto body manufacturers preferring a heavier floor board. Also recommended for heavy shelf construction, store fixtures, concrete form lumber.

⅞ in.—7 ply

Furnishes extraordinary, well-balanced strength. Much used in ship building for bulkhead panels, stateroom partitions, etc.

1 3/16 in.—7 ply

Widely used for instrument boards, ice machine bases, desk tops, bus seats and a variety of other purposes requiring an exceptionally strong and rigid board.

Nail-Pulling Tests—Nail pulling tests were also made on Douglas fir plywood, and the other materials tested in tension and compression, to ascertain their resistance against nail-heads pulling through, when the materials were nailed to a wood base. Eighty-five per cent of the cement coated box nails (a more severe test) used with the plywood were pulled out of the base when the plywood was pulled loose, whereas every other material was pulled loose without removing a single nail; the nail-heads simply punctured the other materials. With plywood the load required varied from 131 to 138 pounds for each 4d box nail up to 275 pounds with 8d box nails; for the other materials (excepting material B) loads averaged only from 45 to 59 pounds per nail for 1½ galvanized roofing nails and 4d box nails. Material B with 4d box nails, required from 92 to 101 pounds per nail.

The superior hardness and splitting-resistance of Douglas fir plywood were evident.

Flexural Tests→Deflection curves, based on a comprehensive series of tests conducted at the Forest Products Laboratory of the University of Washington, are shown on Page 10, under concrete form panels.

These tests show that ⅝-in. plywood sheathing is equal to diagonal flooring as to strength and deflection and furnish the engineer and architect with data to permit use of plywood in a multitude of structural designs.

TABLE OF DOUGLAS FIR PLYWOOD STANDARD SIZES

Item	Widths	Lengths	Thicknesses
Standard Panels Plypanel	From 12″, increasing by 2-in. units to 30″; also 36″, 42″, and 48″	48″, 60″, 72″, 84″, and 96″	3/16″ (3-ply sanded 2 sides) increasing by 1/16″ thicknesses to 1 3/16″ (7-ply)
Wallboard Plywall	48″	60″, 72″, 84″, and 96″	¼″, ⅜″ 3-ply sanded 2 sides; and ½″ 5-ply sanded 2 sides
Sheathing Plyscord	32″ and 48″	96″	5/16″ and ⅜″ 3-ply unsanded, and ⅝″ 3- and 5-ply unsanded

Douglas Fir Plywood Grades

(See U. S. Commercial Standards, CS45-38)

Good Two Sides (G-2-S)—This grade is intended for natural or light stain finishes. Both faces are clear and 100% heartwood of a yellow or pinkish color.

Good One Side (G-1-S)—One face is the same as that described under Good Two Sides grade, while the opposite face is the same as the Sound Two Sides grade described below.

Sound Two Sides (SO-2-S)—This grade presents a smooth, sound surface on both sides suitable for painting. The faces may be of one or more pieces of firm, smoothly cut veneer. If of more than one piece, they will be well-joined and reasonably matched for grain and color at the joints. Sap and natural discoloration are considered no defect.

Wallboard (Plywall)—The face side is the same as described under Sound Two Sides. The opposite side contains defects in number and size that will not affect the strength or serviceability of the panel.

Sheathing (Plyscord)—Both sides of this 5/16-in., ⅜-in. and ⅝-in. unsanded plywood contain defects which will not seriously affect strength or serviceability, but one face is made tight by patching.

Concrete Form Material (Plyform)—(Made in standard panel dimensions with special highly water-resistant glue). ⅝-in. thickness is recommended for most form jobs, but ½-in., 9/16-in., 11/16-in. and ¾-in. panels are stocked in standard panel widths and lengths. Both faces are carefully selected and sanded. When specified, panels will be mill-treated with special water-repellent oil at nominal cost. Panels ¼-in. thick are available as form liners and for curved surfaces.

Exterior (EXT-DFPA)—This class of panel made in various grades and with waterproof glue is suitable for permanent exterior exposures.

DOUGLAS FIR

PLYWOOD

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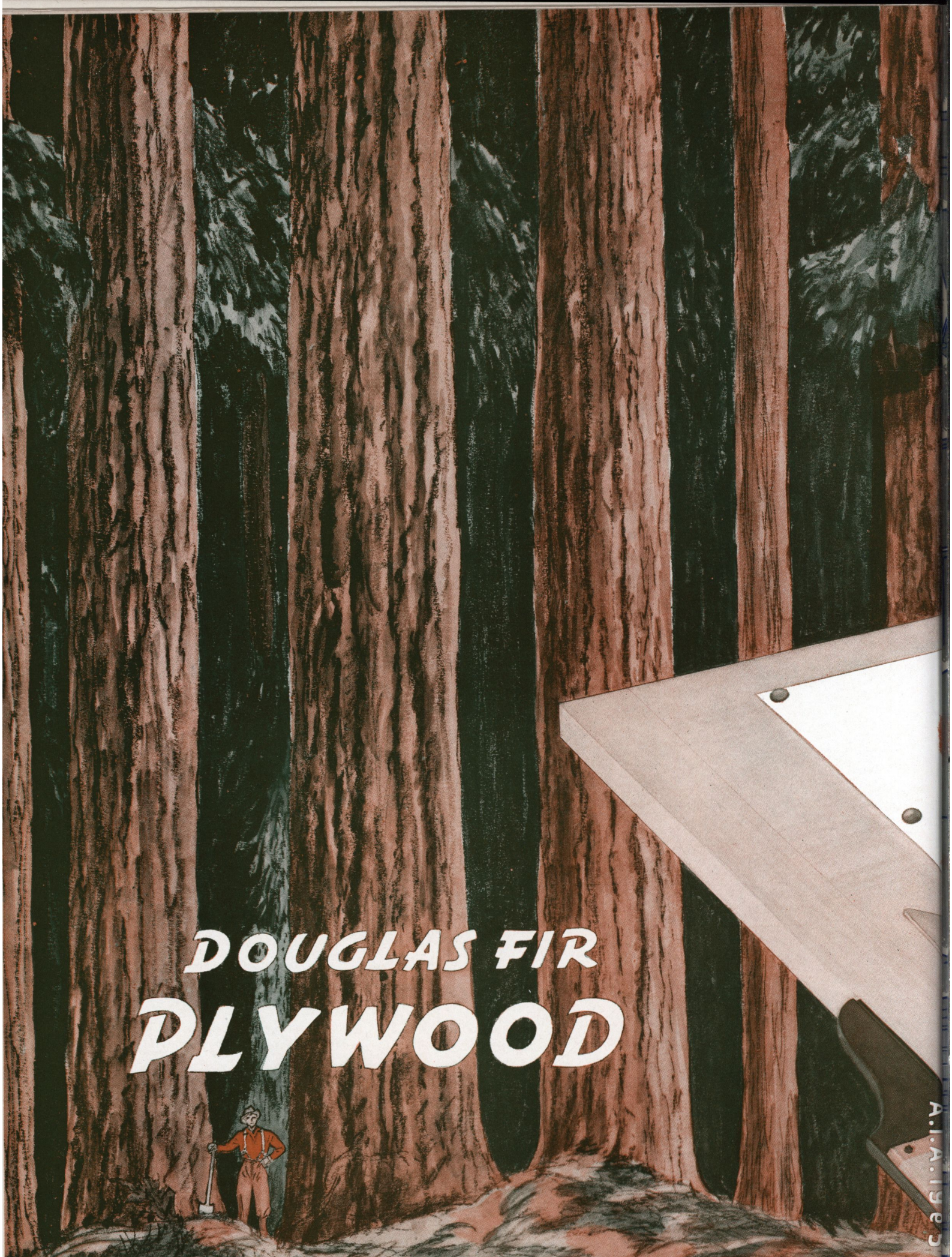
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